Remarks

Claims 37-66 are pending in the current application; reconsideration is respectfully requested.

Claim Objections

Claim 61 is objected to due to a typographical error in the claim. Claim 61 is amended herein to address this issue.

Claim Rejections - 35 U.S.C. § 112

Claims 45, 61-63 and 65-66 are rejected under § 112, second paragraph, as allegedly being indefinite. The Examiner's concerns have been addressed herein via amendment to the claims as suggested by the Examiner.

Claim Rejections - 35 U.S.C. § 102

Claims 50-61 are rejected under § 102(b) as allegedly being anticipated by Hed (US 5,228,923). Applicants traverse.

A. Hed Fails to Teach or Suggest the Claims as Amended

Claim 50: Hed fails to teach or suggest the thermoelectric (TE) power source recited in amended claim 50 for at least the following reason:[1]

- Hed does not teach or suggest a TE power source that operates in the Seebeck mode to transfer heat spontaneously by direct conduction to and from the TE module without the need of an additional electrical and/or mechanical power device to enable the heat transfer.

Hed discloses a thermoelectric heat pump that extracts heat from or inputs heat to a single fluid passing through a series of passages and across both the hot and cold shoes of multiple TE elements in sequence. (See, e.g., Col. 2, ll. 26-51.) To operate as a heat pump the Hed TE elements operate in the *Peltier* mode as opposed to the *Seebeck* mode of the presently claimed power source.

Hed does make mention that his heat pump could theoretically be run "backward" to convert thermal energy to electricity. (Col. 5, ll. 67-68). In this alternative operation mode, Hed requires an external mechanical pump to propel the fluid through passages that then deliver heat to multiple TE hot shoes, and/or remove heat from multiple TE cold shoes to produce electric power. (Col. 6, ll. 24-35; Fig. 5, pump 69 as described in Col. 9, ll. 12-17.)

[1] Support for the claim 50 amendments are discussed below.

- ✓ "A heat exchange fluid is pumped through the inner hollow 42 toward the closed end plate 45 (cold plate) of the external cylinder 41 and returns in the space between the bracing structure 43 and the outer cylinder 41 ... The recirculation pump and the specific plumbing associated with the inner flow and outer flow away from the refrigerator are not shown and these are well known in the prior art, some of these elements are, however, detailed in FIG. 5." (Col. 6, ll. 24-35.)
- ✓ "The heat exchanging fluid leaving the outer cylinders 63 is directed to a hot heat exchanger 68 via a common conduit 67, where heat is discharged to the ambient environment and recirculated by the pump 69 to a conduit 70 which feeds back the heat exchanging fluid to the hollow cores 62." (Col. 9, ll. 12-17; see also FIG. 5.)

Accordingly, Hed does not teach or suggest the recited claim 50 apparatus for generating electrical energy from an environment, which operates in the *Seebeck* mode to transfer heat spontaneously by direct conduction to and from the TE device without the need of an additional electrical and/or mechanical power device to enable the heat transfer. Withdrawal of the rejection is respectfully requested.

Claim 51:

- Hed fails to teach or suggest the recited low-temperature heat pipe capable of transferring heat by a phase change of a working fluid.

Hed discloses a heat pump that extracts heat from or inputs heat to a single fluid passing through a series of passages and across both the hot and cold shoes of multiple TE elements in sequence. (See, e.g., Col. 2, ll. 26-51.) The Examiner incorrectly asserts that Hed "must inherently transfer heat to and from the thermoelectric device by a phase change of the working fluid...." (*Office Action*, page 5).

In rejecting claim 51 in this manner the Examiner concedes that Hed does not expressly or impliedly teach a heat pipe, specifically, a heat pipe and phase change of a working fluid. Nonetheless, the Examiner rejects claim 51, contending that a phase change is inherently taught by Hed. Applicants respectfully traverse this rejection at least because the Office has not met its burden to fully develop reasons supporting its reliance on the doctrine of inherency.

The Office always bears the initial burden to develop reasons supporting a reliance on inherency. (MPEP § 2112 (IV)). To satisfy this burden, the Office must identify some basis in fact or articulate some reasoning at least tending to show that allegedly inherent subject matter necessarily (i.e., inevitability) flows from cited art. Indeed, the MPEP expressly instructs that:

> In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." Further, since a basis in fact and

technical reasoning is required when inherency is invoked, a failure to provide such evidence or rationale is fatal to the reliance on this doctrine. This is only logical since evidence "must make clear" that the allegedly inherent subject matter is necessarily present in (i.e., necessarily flows from) the disclosure of cited art. (MPEP § 2112).

The Examiner has failed to provide a basis in fact but merely erroneously asserts that the Hed structure and material is the same as the claimed device – this is clearly wrong, and a simple reading of Hed and the present application, or even a simply review of the figures of each document, show the structures are not anywhere near identical. Accordingly, there is an absence of the required rationale or evidence at least tending to show that a working fluid phase change occurrence in the fluid pathways of Hed inevitably flows from the disclosure. The Examiner's incorrect assertion that the two structures are the same cannot reasonably be said to be a development of any reason supporting the reliance on inherency. At no point does Hed state or imply or even suggest that its fluid paths are heat pipes nor does it ever teach, suggest or in any manner imply that there is a phase-change in its fluid paths. A phase change in the working fluid in the fluid pathways of Hed is not necessary for operation of the device. Consequently, the Office's reliance on inherency is unsupported and thus improper. In sum, the Office concedes that Hed does not teach the heat pipes of claim 51 and any reliance on the doctrine of inherency to provide this necessary teaching is improper.

Withdrawal of the rejection is respectfully requested.

Claims 52-61: Claims 52-61 are allowable over Hed for the reasons set forth above as well as each claim's unique and non-obvious combination of features.

B. Support for Amendment of Claim 50

Claim 50 is amended to recite "the apparatus not including an additional electrical and/or mechanical power device, other than gravity, external to the high temperature heat pipe acting on the working fluid to transfer heat to and from the thermoelectric device." Applicants provide the following evidence of support in the present application for the amendment preceded by a brief discussion regarding the law and MPEP guidelines for meeting written description requirements.

Explicit language "the apparatus not including an additional electrical and/or mechanical power device, other than gravity, external to the high temperature heat pipe acting on the working fluid to transfer heat to and from the thermoelectric device" in the application is not required to meet the written description requirement. The MPEP at § 2173.05(i) states that there does not need to be a literal basis in the specification for a claimed feature. Further:

- When a disclosure describes a claimed invention in a manner that permits one skilled in the art to reasonably conclude that the inventor possessed the claimed invention the written description requirement is satisfied. (MPEP §2163). This possession may be shown in any number of ways

and an Applicant need not describe every claim feature exactly because there is no *in haec verba* requirement. (MPEP § 2163). Rather, to satisfy the written description requirement, all that is required is "reasonable clarity." (MPEP § 2163.02). Also, an adequate description may be made in any way through express, implicit, or even inherent disclosures in the application, including words, structures, figures, diagrams, and/or formulae. (MPEP §§ 2163(I), 2163.02).

Accordingly, with the question being "what would one of ordinary skill in the art understand from reviewing the present application," it is clear that a skilled person would readily understand that external electrical and/or mechanical devices external to the low temperature or high temperature members (other than gravity if the Examiner chooses to interpret gravity as being a device) are not necessary nor included as part of the disclosed thermoelectric power source device.

Initially, it is important to note that the subject claim language is recited because the Examiner cites, against the claims of the application, the Hed reference that discloses a heat pump that operates in the Peltier mode, not a power source that operates in the Seebeck mode (as discussed above). For the Hed device to operate in the Seebeck mode, the device must be run "backward" requiring an external mechanical power source, a pump, to force a liquid through a series of passages. Although obviously designed for a completely different purpose (a cooling device for refrigeration), because of the citation against the current claims, the present claims are amended to positively recite that such an external power source as required in Hed (when run backward) is not required for or included in the currently claimed power sources.

The present application, when read in its entirety (not treating each sentence as an individual statement not tied to anything else) is clear to one of ordinary skill in the art that the presently claimed embodiments of the power source do not include electrical and/or mechanical devices external to the high temperature heat pipe (other than gravity) to operate the claimed thermoelectric power source devices. Specifically:

1. Applicants' specification first indicates in the Background section the need for power sources that do not require external power sources to drive the power source. See the following (direct quotes):

- The increasing use of portable electronics has driven research in the area of *portable* electric generators. (p. 1, lines 19-20). [An implication that external sources of power to run the power supply is a problem that the present invention is addressing.]
- Fitting every sensor with a battery power supply involves the above noted performance limitations of batteries in addition to the high cost of initial installation and periodic replacement. The alternative of hard wiring a large number of sensors to a central supply would improve reliability, but would necessarily involve complex circuitry and cost that make this approach economically unviable. These deficiencies of conventional solutions can be overcome by use of TE power sources such as TE

power sources *that produce electric power by harvesting and converting ambient energy in the manner provided by this disclosure.* [An implication that it is ambient air differences that run the new power source devices for the creation of power – not an external electrical and/or mechanical device to run the power source.]

- One potential source of energy for the presently disclosed TE power sources and devices may be found in the differing temperatures that occur naturally in these remote, non-remote and less accessible locations, since thermoelectric devices can generate electric power in response to the existence of a temperature differential across the thermoelectric device. However, since the distances across conventional thermoelectric devices are typically small, heretofore none have been successfully configured to take advantage of the temperature variation between, for example, the ground below and the air above it. (p. 4, line 27 – p. 5, line 5). [Another implication that it is only natural temperature differences between ambient air and another part of the environment that run the new power source devices for the creation of power – not an external electrical and/or mechanical device.]

2. Applicants' specification provides embodiments of the presently claimed power source with text and drawings that make it clear there are no external electrical and/or mechanical power sources connected to the claimed power source to drive the claimed power source and any reasonably person, not just those of ordinary skill in the art, would recognize such from the following:

- With reference to Figure 15 the specification states: Such a TE power source may include an embodiment of the disclosed thermocouple assembly (TE modules), a heat delivery member and a rejection member (e.g., a low-temperature and a high-temperature heat pipe containing for example condensable fluids), and interfacing electronics including annular electronics, and power conditioning compartments. The heat delivery member and a rejection member may be coupled to the hot and cold junctions or connections of the TE modules. One or both sides of the generator can be heated or cooled by other heat transport methods such as conduction, convection, and/or radiation. One or more sensors or other low-power applications, for example, may be powered by the disclosed power source. (p. 24, line 16 – p. 25, line 2.) [A skilled person would yet again see that there is no mention of any electrical or mechanical power device external to the high and low temperature members of the described power source needed to cause the spontaneous heat transfer in the power source.]

- The TE ambient power source embodiment shown in FIG. 15 can produce from power in the range of 100 microwatts to 100 milliwatts, *from small ambient*

differences in temperature (e.g., less than about 5°C, less than about 2°C, or less than about 1°C). For example, the disclosed power source embodiment may operate in environments where natural temperature differences exist, such as above and below ground surface, water to air temperature differences, skin to air temperature differences or on either side of ductwork that delivers heating, ventilation, and/or air-conditioning in buildings or appliances. ... Particular embodiments of the TE power sources as disclosed herein can be used *through energy taken directly from the local environment of the application using engineered heat gathering and dissipation components.* (p. 25, lines 3-22.) [Yet another implication that it is only natural temperature differences between ambient air and another part of the environment that run the new power source devices for the creation of power – not an unmentioned external electrical and/or mechanical device. Again – there is no mention whatsoever of any need of an external electrical or mechanical power device to run this disclosed power source – nor is there any mention of such anywhere in the application – another obvious indicator to persons skilled in the art that no electrical or mechanical power device external to the described power source is needed to drive the described power source.]

- Figure 15 itself indicates that there is no electrical or mechanical power device external to the high temperature and low temperature heat pipes of the drawn power source.

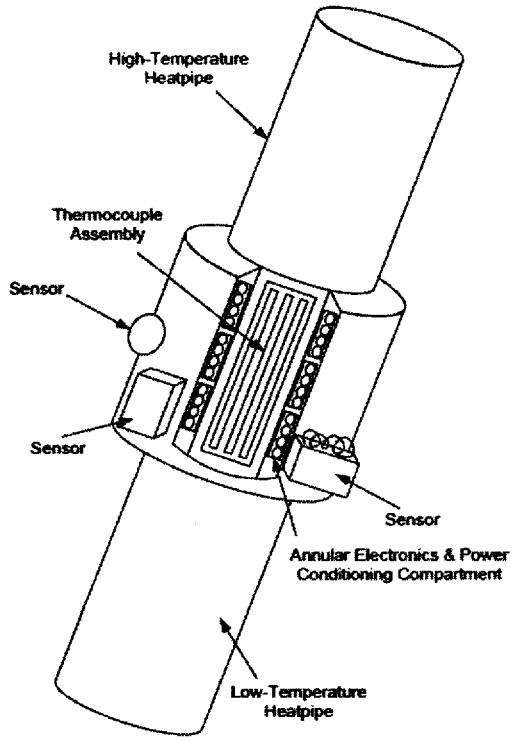

Fig. 15

When a disclosure describes a claimed invention in a manner that permits one skilled in the art to reasonably conclude that the inventor possessed the claimed invention the written description requirement is satisfied. (MPEP §2163). This possession may be shown in any number of ways and an Applicant need not describe every claim feature exactly because there is no *in haec verba* requirement. (MPEP § 2163). Rather, to satisfy the written description requirement, all that is required is "reasonable clarity." (MPEP § 2163.02). Also, **an adequate description may be made in any way through express, implicit, or even inherent disclosures in the application, including words, structures, figures**, diagrams, and/or formulae. (MPEP §§ 2163(I), 2163.02).

In view of the foregoing, Applicants respectfully submit that ordinarily skilled artisans would reasonably conclude through reading Applicants' disclosure that the Applicants possessed the claimed power sources including, among other things, low-temperature and high-temperature members that operate in the Seebeck mode to transfer heat spontaneously to the and from the TE device to produce electrical power without the need of electrical and/or mechanical power device, other than gravity, external to the low temperature or high temperature heat pipes to enable the heat transfer. Thus, the amendment of claim 50 is supported.

Claim Rejections - 35 U.S.C. § 103

A. ***Claims 37-49 are rejected under § 103(a) as allegedly being unpatentable over Migowski (WO 89/07836).*** Applicants traverse.

Claim 37: Claim 37 recites, in part, a method for providing electrical energy to an electrical device comprising providing a thermoelectric device having a plurality of thermocouples comprising p-type and n-type thin film semiconductor thermoelements formed on a single flexible substrate, the p-type or the n-type thermoelements having L/A ratios from about 100 cm^{-1} to about 10,000 cm^{-1}.

The Examiner cites *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), as a basis for her rejection that even though Migowski completely fails to teach or suggest the claimed L/A ratio, it nonetheless makes the claimed invention obvious because the L/A ratio is allegedly merely a dimensions design choice. In *Gardner* the Federal Circuit held that,

> where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device ***and a device having the claimed relative dimensions would not necessarily result in differences in performance over the prior art***, the claimed device was not patentably distinct from the prior art device.

As discussed in detail in the § 1.132 Declaration filed herewith, Applicants illustrate that by varying L/A ratios within the claimed ranges, Applicants' power sources produce up to 70 times the output as directly compared to the Migowski power source, the closest prior art. Applicants illustrate that through varying the L/A ratio within the claimed ranges, Applicants claimed power sources result in a remarkable increase in output *even when otherwise constrained to the same design limits*[2] *and exposed to the same environmental conditions as disclosed in Migowski.*

Applicants note the following:

- Migowski fails to teach or suggest a power source utilizing the claimed L/A ratios.
- Applicants have provided evidence in § 1.132 Declaration form that the claimed invention has significantly improved performance as directly compared to the Migowski device.[3]
- Applicants have provided evidence in § 1.132 Declaration form of the criticality of the L/A ratio to the power performance of thin film thermoelectric power sources.

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[2] Migowski fails to disclose the compositions of his thermoelements and provides no information regarding the *Seebeck* coefficient of his thermoelement composition. Accordingly, there is no way to know what the Migowski compositions were or what effect, if any, the compositions might have on the Migowski device performance or whether a device was ever made and tested; the reported electric output may be purely theoretical.

[3] Again, note that because Migowski does not teach what compositions are used for its thermoelements or disclose a *Seebeck* coefficient for the materials, there cannot be an absolute direct comparison – that is, nothing in Migowski teaches or suggests it uses the compositions of the presently claimed invention.

- Applicants have provided evidence in § 1.132 Declaration form of the unexpected nature of the significantly improved performance of the claimed invention.
- Evidence of unexpected results may be in the form of a direct comparison of the claimed invention with the closest prior art that is commensurate in scope with the claims. MPEP § 716.16(b)(III), *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). A direct comparison to Migowski, commensurate with the scope of the claims, is presented in the § 1.132 Declaration.
- Because the L/A ratio is result effective, the complete failure of the prior art to teach or suggest power sources having the recited L/A ratio, cannot be "excused" based on the allegation that the L/A ratio is a mere dimension limitation (it is noted that the Examiner has not explicitly asserted this basis for rejection).
- Although the Examiner has not explicitly asserted a "mere optimization" based rejection, Applicants note that because the prior art did not recognize that the L/A ratio is a result-effective variable, Applicants' determination of desirable ranges of the L/A ratio cannot be dismissed as obvious, routine experimentation.

In citing the *Gardner* case and putting forth the assertion that it is not necessary for Migowski to teach or suggest the L/A ratio if it is a "dimensions change" the Examiner apparently is relying on the suggestion stated in MPEP § 2144, which instructs that a rejection may be made under § 103 even if the Examiner's rationale to modify the prior art to fit the claimed invention is not stated in the prior art; such a rationale may be based on legal precedent established by prior case law (here, the Examiner suggests *Gardner*). That is, MPEP § 2144, instructs "If the facts in a prior legal decision are sufficiently similar to those in an application under examination, the examiner may use the rationale used by the court."

As the Examiner knows, however, if Applicants have demonstrated the criticality of a specific limitation - here the L/A ratio - it is not appropriate to rely solely on case law as a rationale to support an obviousness rejection. The § 1.132 Declaration of John DeSteese filed herewith evidences that the L/A ratio range is critical and produces unexpected superior results. The § 1.132 Declaration provides evidence of this criticality by providing a description of precisely what was tested/compared holding both the Examples of the claimed invention and the Migowski disclosed method to identical parameters other than varying the L/A ratio, tabulating the comparison results over the scope of the claimed range to the Migowski disclosed power source parameters, and describing exactly how the Example output values were calculated (Migowski discloses an output value of 11 μm).

In addition, the Declaration sets forth the statistical and practical significance of the unexpected superior output values of the claimed method. Applicants note in *In re Waymouth*, 499 F.2d 1273, 1276, 182 USPQ 290, 293 (CCPA 1974), the court held that unexpected results for a claimed range as compared with the range disclosed in the prior art had been shown by a demonstration of "a marked improvement, over the results achieved under other ratios, as to be classified as a difference in kind, rather than one of degree." In addition, as stated in MPEP § 716.01 and in *In re Wagner*, 371 F.2d 877,

884, 152 USPQ 552, 560 (CCPA 1967) the court notes that differences in properties cannot be disregarded on the ground they are differences in degree rather than in kind. Accordingly, the marked improvement of output of the presently claimed power source methods over the prior art – especially the closest prior art, Migowski – evidences unexpected results.[4] See also, MPEP § 716.02.

Furthermore, the Examiner's reliance on *Gardner v. Tec Systems, Inc.*, 725 F.2d 1388 (Fed. Cir. 1984) fails to note two important differences between the *Gardner* case as compared to the presently claimed methods and Migowski:

- First, in the *Gardner* case the prior art did not claim specific dimensions - so it was unclear whether the dimensions were different or the same as the patented device. Here, the Migowski reference clearly discloses an L/A ratio far outside the range recited in the method claim; and
- Second, in *Gardner* there was no showing that the contested general dimensions would change the performance of the device. In the current application, however, in addition to the § 1.132 Declaration, Applicants' specification itself indicates how the L/A ratio is vital to the performance of the thermoelectric device/method. Specifically, Applicants determined through testing that a key parameter affecting the power produced by the thermoelements is the length-to-area (L/A) ratio of the individual thermoelements. Applicants provide particular L/A ratios so to achieve desired power outputs at large enough voltages to be directly applicable to intended particular devices needing power, without having to provide voltage amplification. This range is tailored for power source methods intended for particular uses needing the particular power output the claimed methods provide. Put another way, the L/A ratios and dimensionalities taught by Applicants critically govern the difference between acceptable and non-acceptable output of a desired method/device.

Because Migowski fails to teach or suggest a device or method within the recited L/A ratio ranges and the § 1.132 Declaration filed herewith evidences both the criticality of the L/A ratio as well as the unexpected nature of the performance of devices and methods within the claimed L/A ratio range, claim 37 is allowable over the art of record.

Claims 38-49: Claims 38-49 are allowable over Migowski for the reasons set forth above, for the reasons set forth in the prior filed Amendment (which arguments are re-asserted but not re-iterated herein) and based on each claim's unique and non-obvious combination of features.

[4] Evidence of unexpected results may be in the form of a direct comparison of the claimed invention with the closest prior art that is commensurate in scope with the claims. See, e.g., *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

B. Claims 50-61 are rejected under § 103(b) as allegedly being unpatentable over Hed (US 5,228,923) in view of Stachurski (US 4,125,122). Applicants traverse.

Stachurski does not make up for the deficiencies of Hed as discussed above. In fact, Stachurski, like Hed, requires a power source external to the heat pipes to operate in the Seebeck mode to transfer heat spontaneously to the and from the TE device. See, e.g., Stachurski, Figs. 1 and 4, the pump noted as reference no. 31; and col. 4, ll. 53-63.

In addition, modifying Hed with the liquid/vapor phase change taught by Stachurski would change the principle of operation of Hed. "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." MPEP § 2143.01(VI). Furthermore, there is no articulated reason why a skilled person would modify Hed to have such a phase change. This is especially true since Hed is designed to operate in the Peltier mode.

Moreover, even if such a modification of Hed were to be made, the Hed device would still require a pump external to the annuli to operate in the Seebeck mode to transfer heat spontaneously to the and from the TE module. That is, the heat amounts that Hed processes would not be amenable to transfer or rejection by natural conduction or convection as taught by Stachurski; as a result, Hed requires the means for forced convection produced by an external circulating or pumping device.

Accordingly, claims 50-61 are allowable over Hed and Stachurski whether considered independently or in combination.

C. Claims 50-62 are rejected under § 103(a) as allegedly being unpatentable over Migowski (WO 89/07836) in view of Simeray et al. (US 6,340,787), and further in view of Stachurski (US 4,125,122). Applicants traverse.

The Examiner is in error asserting that Simeray's thermally conductive stake (74 in Figure 6) is a heat pipe. Simeray makes no reference to use of a heat pipe. A thermal stake such as shown in Simeray using simple heat conduction would not be effective (as would a heat pipe) in bringing low quality ambient heat to a thermoelectric generator. Accordingly, Simeray does not make up for the deficiencies of Migowski or Stachurski.

Applicants believe the claims recited in the subject application are allowable over the art of record and notice to that effect is respectfully requested.

D. Claims 50-66 are rejected under § 103(a) as allegedly being unpatentable over Albsmeier et al. (WO 02/095707) in view of Migowski (WO 89/07836) in view of Simeray et al. (US 6,340,787) and Stachurski (US 4,125,122). Applicants traverse.

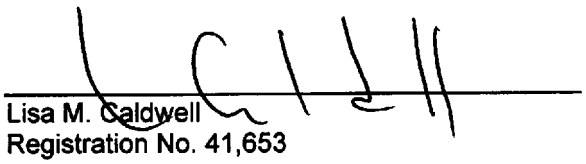
Besides the fact that the Examiner is citing, as a primary reference, the Albsmeier device which has nothing to do with thermoelectric devices, Albsmeier does not make up for the deficiencies of Migowski, Simeray and Stachurski since Albsmeier does not teach or suggest the claimed heat pipe. In

fact, the Examiner does not even contend Albsmeier teaches or suggests such heat pipe but instead relies on the other cited references for such. As discussed above, each of the secondary references also fail to teach or suggest the claimed heat pipes as well as the claimed TE device that operates without an electrical and/or mechanical power device external to a high temperature heat pipe acting on a working fluid to transfer heat to and from the thermoelectric device. Accordingly, no reference cited teaches or suggests the claimed TE device and Albsmeier does not make up for the deficiencies of Migowski, Simeray or Stachurski.

Applicants believe the claims recited in the subject application are allowable over the art of record and notice to that effect is respectfully requested.

Respectfully submitted,

KLARQUIST SPARKMAN, LLP

By 

Lisa M. Caldwell
Registration No. 41,653

One World Trade Center, Suite 1600
121 S.W. Salmon Street
Portland, Oregon 97204
Telephone: (503) 595-5300
Facsimile: (503) 595-5301